# Gas Journal

VOL. 296. 110th YEAR. LONDON, OCTOBER 8, 1958. No 4969. PRICE 1/6

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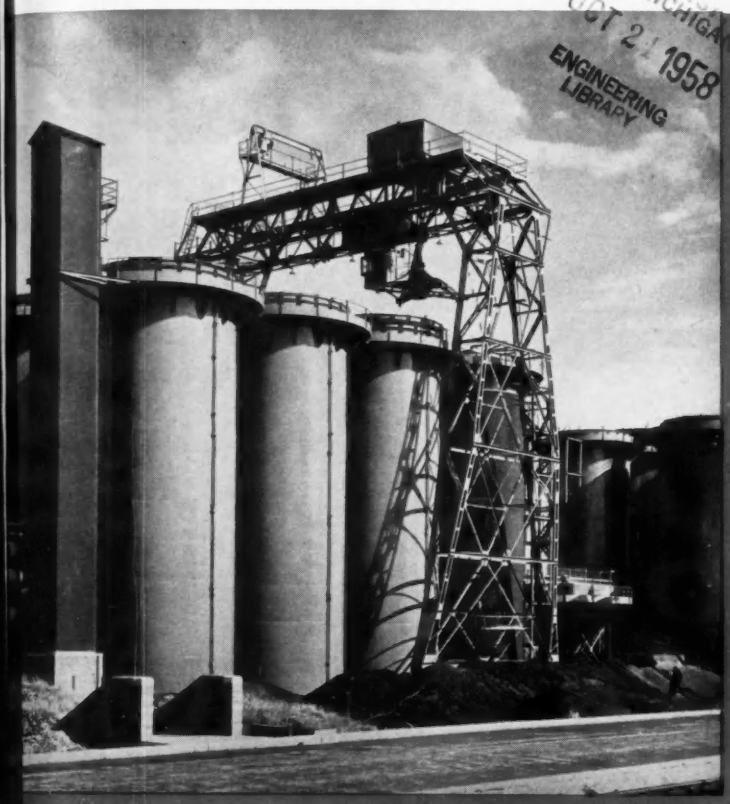

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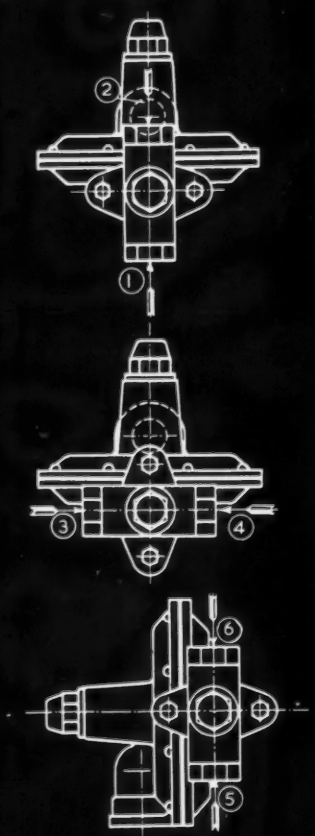


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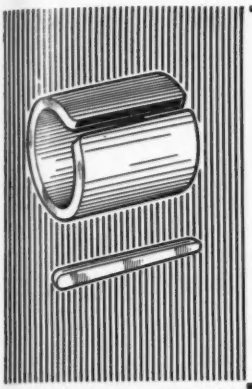

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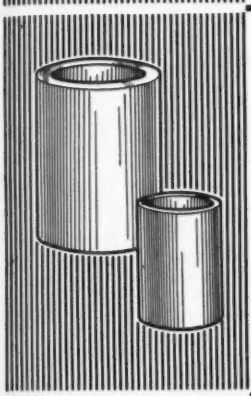

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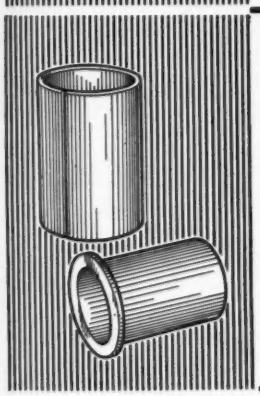

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# Gas Journal

VOL. 296 NO. 4969 OCTOBER 8, 1958

110TH YEAR

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Published by Walter King Limited, 11, Bolt Court, Fleet St., London, E.C.4

Telephone: FLEet Street 2236-7 Telegrams:- Gasking, Fleet.


## CONTENTS

### 7th INTERNATIONAL GAS CONFERENCE


Editorial Comment: In Foro Romano - - - - - - 59

Stabilising the Energy Market. By J. A. van den Heuvel - - 60

Report from Rome: A Review - - - - - - - - 63

Pictures Taken at Rome - - - - - - - - 65

The Pope's Address to Conference - - - - - - 66

Review of Technical Sessions (with Discussions): Complete Gasification; Gas Must Pass a Threshold; Petroleum in Gas Manufacture; Automation in Pipeline Operation - - - - - - - - - - 67

International Statistics; Prevention of Gas Explosions; Refinery Gas at Naples; Applied Chemical Engineering - - 71


### NEWS OF CURRENT EVENTS


Personal - - - - - - - - - - - - 61

Obituary - - - - - - - - - - - - 61

Diary - - - - - - - - - - - - - 61

Salesmen Fly Themselves Across Africa - - - - - - 62

Power-Gas Corporation Gets Order from Spain - - - - 62

Eire Finds it Cheaper to Ship Coal from U.S. - - - - - 62


PUBLISHERS' NOTICE, SEE PAGE 81

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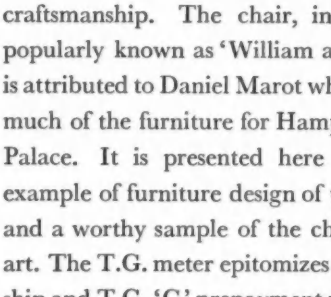
# something in common

They remind one of different worlds, the antique chair of 1680-1700 and the modern T.G. meter. Yet they *have* something in common — both are the products of true craftsmanship. The chair, in the style popularly known as 'William and Mary', is attributed to Daniel Marot who designed much of the furniture for Hampton Court Palace. It is presented here as a fine example of furniture design of that period and a worthy sample of the chairmakers' art. The T.G. meter epitomizes craftsmanship and T.G. 'G' prepayment mechanism is accepted as the most modern precision movement on the market.



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# Gas Journal

VOLUME 296. No. 4969 OCTOBER 8, 1958. 110th YEAR


## *In Foro Romano*

THE Seventh International Gas Conference, which was held a fortnight ago in Rome, was claimed by the outgoing President (Dr. Mario Boselli, of the Société Edison, Milan) to have made a new record as regards both numbers in attendance and quality of the reports and papers presented. We agree; and we applaud the progress made by the International Gas Union in the short period which has elapsed since the first inaugural conference in London on June 3, 1931—in only 27 years, of which it can be said that eight were rendered void while the scientists and engineers of the world were pitted against each other in bloody conflict.

Now it would appear that in scientific and engineering circles there is more co-operation and friendliness than in any other branches of political or economic activity. Among the 550 delegates to the Rome Conference were the élite of the gas men of 19 countries; and new members of the Union are Rumania and Russia—whose thirst for knowledge is insatiable.

At the Conference, in the super-comfort which we describe elsewhere in this issue, we looked and listened and formed an opinion; and asking numerous delegates, had our opinion confirmed—that such a conclave is without doubt of the greatest help, not only from the knowledge propagated by papers and discussions but from the informal contacts and conversations which are sought on every hand. In a contribution to a discussion (and we rate it of such importance as to reproduce it on the page following) Mr. van den Heuvel, Chief of the Fuel and Power Department of O.E.E.C., said the gas industry 'to guide its efforts has still to form an opinion on the future aspects of the energy economy in 10 or 20 years time . . . . considering as a whole all the factors involved in the different sectors.' The deliberations of that live body, the International Gas Union, guide one quite a way along the road which for this country at any rate is characterised by bends for many miles ahead.

The more live a scientific body, the more written and spoken words emanate from it; and we often speculate as to how much of this specialist knowledge ever reaches the general light of day. The output has grown immeasurably in the last 35 years. It may be of interest to record, for example, that from about 1863 until the early twenties there existed a handy arrangement between the Institution of Gas Engineers and the 'GAS JOURNAL' whereby the Institution paid the 'JOURNAL' for setting in type its papers *in extenso* and, as a *quid pro quo*, the 'JOURNAL' took the 'verbatim' of the discussions and presented the result to the Institution. The eventual outcome was an annual volume of Transactions of around 450 pages. Today the reproduction of a single Autumn Research Report might well commandeer the space available (by courtesy of printer, paper maker and Postmaster General) in two whole issues of the 'JOURNAL.'

At the Rome conference 45 reports and papers were presented. The I.G.U. offered the copyright of these to 'one only technical journal in each country' for the round and tidy sum of $2,500 (American). Whether the auction took place and there were any bidders, we do not know; good as the great majority of the papers were, it would have been a big sum to pay for the mortgage of a year's issues. There being twin sessions, a total of 35 hours was allotted for presentation and discussion. And so we are content to offer to our readers, in this and subsequent issues, our own technical review of the reports and papers and the high lights of discussion, which we hope will point the necessity or otherwise of obtaining the full text.

As a final reflection—steeped, maybe, in insular pride—we would say that as in New York three years ago, so in Rome, we were impressed by the lion's contribution of the keen and organised British team. Of course, most of the other member countries have had silver spoons thrust into their mouths and some may be beginning to regard us with curiosity—as though to say 'Do you really still have to focus your camera'? But we remain all-rounders and for many years will have to rely on more than turning-on the valve.

# STABILISING THE ENERGY MARKET

***The future role of the Gas Industry, as described at the 7th International Gas Conference in Rome by J. A. van den Heuvel, Head of the Fuel and Power Division, O.E.E.C.***

RAW materials largely determine today, and will certainly condition in the future, the place occupied by the gas industry in the general energy economy of certain important areas of the world. Forgive me if, as representative of the Organisation for European Economic Co-operation, I think first of Western Europe.

Several papers presented to the congress express concern about future supplies of coking coal. We are of course all aware of the existence of this problem, but I think I ought to say that it is an economic question far more than a problem of quantity. Very large amounts of coking coal are still available in the world, but their transportation and import may raise trade and balance of payments problems which, in certain circumstances, may be hard to overcome. Above all, we must not forget that we still have in Western Europe considerable resources of coking coal, a large part of which, however, is used for purposes other than carbonisation. Appropriate economic arrangements might make it possible to cope with this regrettable situation. Lastly, is it certain that the iron and steel industry will in future need constantly increasing quantities of coke? New techniques in course of development may easily bring about fundamental changes in this field.

The gas industry is now turning more and more towards liquid fuels. Like many others, it obviously feels some concern about the security of supplies of this raw material. But did we not succeed, thanks to co-operation between governments and between them and the world oil industry, in overcoming the Suez crisis without serious repercussions on our economies? Moreover, a report by our Organisation's Oil Committee, published at the beginning of this year, shows that our underground resources hold out serious chances of important discoveries of crude oil. This same Committee also urged the Council to formulate certain recommendations to the governments of member countries concerning an adequate policy for the storage of liquid fuels. Natural gas, in its turn, now justifies our hopes for its future development. The report of the Oil Committee, to which I have referred, also covers these prospects.

## Nuclear Energy

There remains nuclear energy, the development of which is still accompanied by a great many uncertainties both in the technical field and as regards its economic possibilities. There is however no shadow of doubt that it will have a very large part to play in the future as a source of heat and a source of electrical energy. It is in this latter field that it will lead to a gradual replacement of traditional thermal power stations and, in doing so, may aggravate the problem of the use of low grade coal. I would like to say: 'There, gentlemen of the gas industry, is a new source of cheap raw materials,' but I am aware that you are already studying this question.

This outline is necessarily very brief and does not deal in any detail with the highly complex problems which characterise the energy question as a whole. It is however possible to formulate a few general considerations concerning your industry.

The gas industry being both a consumer of a large variety of forms of primary energy and a promoter of their efficiency by processing them into an essentially 'rich' form of secondary energy, is destined to play an increasingly important part in stabilising the energy market. The pioneer spirit it has displayed, its daring research and its vigorous approach to new experiment, merits our complete confidence. To guide its efforts, it has still to form an opinion on the future aspects of the energy economy—in ten or twenty years' time—and to do this it must have the possibility of considering as a whole all the factors involved in the different sectors, often a very difficult task for those whose responsibilities are confined to a single sector.

## Forecasts Attempted

It is for this reason that our organisation for more than five years past has endeavoured to draw up, for a period up to 1975, forecasts for the supply and demand of all forms of energy, taking into account all the economic and technical factors which affect this development. We first had the Hartley Commission which published its report at the beginning of 1956; now we have the Energy Advisory Commission, consisting of nine very high-level experts absolutely freed from any national or industrial influence, which is endeavouring to bring up-to-date and complete the work of its predecessor. It has been able to benefit, in particular, by consultations with our Gas Committee, which has been in existence for nearly three years, and it also solicits the views and experience of industrial circles. Its report, which is expected to be published in the first half of next year, will cover mainly long-term developments and will not deal more than is strictly necessary with comparatively brief fluctuations of the economic situation which were mentioned in some of yesterday's discussions. I feel I ought to make it quite clear that its report will in no way represent 'controlled planning' in the derogatory sense so often given to that term. We are simply trying to set up a background against which governments on the one hand and industrialists on the other can project their own development plans, to ensure that they fit in with the general predictable development of energy.

I am fully confident in the future of the gas industry as a whole, and am particularly grateful for the stabilising role which it seems prepared to assume in the general development of the energy economy.

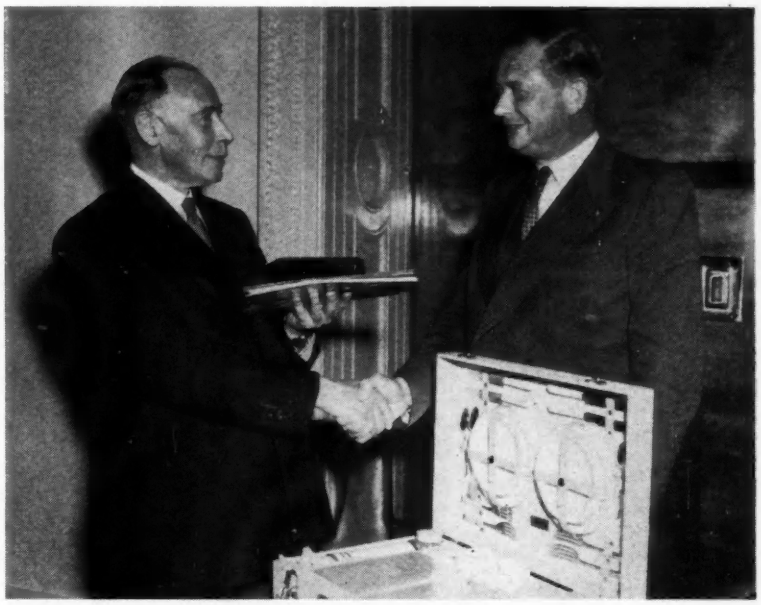
# Personal

MR. H. JOHNSTON, O.B.E., has been appointed a member of the North Eastern Gas Board. Mr. Johnston will combine the duties of Board membership with those of his present position as Chief Engineer of the Board. Immediately before vesting date Mr. Johnston was Engineer-in-Charge of the Bradford gasworks; after nationalisation he was appointed Chief Engineer of the North Eastern Gas Board. Mr. Johnston has served, or is serving, on most of the National Committees of the Institution of Gas Engineers. He is Past-President of the Manchester and District Association of Gas Engineers.

MR. J. B. RICHARDSON has been promoted Office Manager in charge of financial and clerical administration in the Greenock area of the Scottish Gas Board. Other executives at the Greenock undertaking are MR. WILLIAM KIRK, District Manager in charge of consumer services, and MR. LEWIS BAIN, Station Engineer in charge of production.

MR. LESLIE WALKER, Engineer in the Industrial Department headquarters of the West Midlands Gas Board, has been appointed Assistant Industrial Gas Officer. He succeeds MR. ARTHUR HIGGS, who has joined the Scottish Gas Board as Area Industrial Gas Sales Development Officer.

MR. H. G. ALLEN, Director of Falk, Stadelmann & Co. Ltd., will be visiting New York, Philadelphia, Pittsburg, Atlantic City, Chicago and Los Angeles in connection with liquid gas lighting units and is attending by special invitation the American Gas Association annual convention during October.



*Mr. F. G. Brewer, O.B.E., who retired at the end of September from the Secretaryship of the Gas Council, a position he has held since its inception, was presented with a silver cigarette box and a picnic hamper by Mr. W. Bailey (who succeeds him as Secretary) on behalf of his colleagues and friends at the Gas Council.*

MR. W. KIDMAN is to be the first Public Relations Officer of the West Midlands Gas Board. Mr. Kidman is a Staffordshire journalist who has spent the whole of his professional career in the West Midlands and is well known in Scotland and Wolverhampton.

MR. J. C. F. HOOD, who left the Sunderland works of the North Western Gas Board earlier this year to take up a position on the engineering staff of the Oriental Gas Co., Ltd., has now been appointed Engineer and Adviser to the Company in Calcutta.

MR. K. W. FRANCOMBE has resigned his position as Chief Chemical Engineer and head of the chemical engineering group of Whessoe, Ltd. His successor is MR. J. THOMPSON, a former Director of APV Engineering Co., Calcutta.

MR. G. C. COOPER, Distribution Superintendent at Blyth, Northumberland, for the Northern Gas Board, has retired after 52 years in the gas industry. His successor is MR. VICTOR BURROWS.

MR. JOHN THOMPSON, Manager of the Stanley, Durham, office of the Northern Gas Board, has retired after 51 years in the gas industry.

MR. OWEN R. GUARD has been appointed part-time member of the Southern Gas Board.

SIR HOWARD ROBERTS, C.B.E., has been appointed part-time member of the South Eastern Gas Board.

# Diary of Forthcoming Events

**October 9.** — WALES G.C.C.: Bute Terrace, Cardiff. Meeting at 11 a.m.

**October 9.**—EASTERN JUNIORS: Letchworth. Paper on Instrumentation and visit to the Sigma Instrument Co., Ltd.

**October 11.**—WALES AND MONMOUTHSHIRE JUNIORS: Bull Hotel, Llangefni, Anglesey. Chairman's Day Meeting. 2.30 p.m.

**October 15.**—SOUTH EASTERN SECTION, I.G.E.: Radiant House, Bristol. Annual General Meeting.

**October 15.**—EASTERN SECTION, I.G.E.: Visit to Sundon Works of Skefco, Ltd.

**October 16.**—MIDLAND JUNIORS: Visit to works of Fisher & Ludlow, Ltd., Birmingham.

**October 17.** — SCOTTISH WESTERN JUNIORS: 24, Walls Street, Glasgow. Paper on the reorganisation of consumer services within Glasgow District by Mr. A. Mitchell, followed by a tour of the Consumer Service Bureau. 7 p.m.

**October 18.** — YORKSHIRE JUNIORS: Bridge Street, Leeds. Annual General Meeting. 2.30 p.m.

**October 18.** — WESTERN JUNIORS: Radiant House, Bristol. Installation of new President followed by a paper by Mr. R. G. Laycock, Solicitor to the South Western Gas Board. 2.30 p.m.

**October 20.**—WOMEN'S GAS FEDERATION: Headquarters' Branch: Murdoch House, 1, Grosvenor Place, S.W.1. 'Careers and Opportunities in the Gas Industry,' by Dr. A. B. Badger. 2.30 p.m.

**October 20.**—EASTERN G.C.C.: Connaught Rooms, Great Queen Street, Kingsway, W.C.2. Meeting at 11 a.m.

# Obituary

MR. JOHN GREEN, formerly Engineer and Manager of the Wisbech Gas Company, died on September 8. He was President of the Eastern Counties Gas Association in 1931.

MR. W. G. S. CRANMER, who designed Willenhall's first gasworks in 1893, has died aged 87.

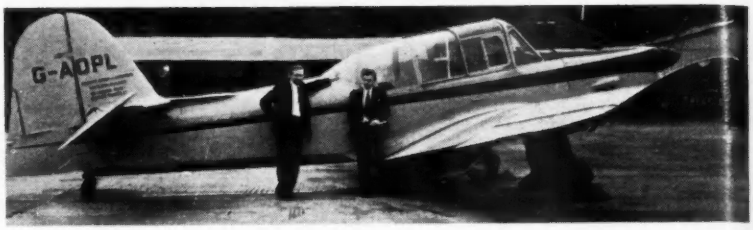
## Radiation Dividend

Radiation Ltd. are to pay an interim dividend of 3% on the 6% cumulative preference stock, and to defer consideration of a payment on the ordinary stock until the results for the year are available.

# SALESMEN FLY THEMSELVES ACROSS AFRICA

TWO young men with an idea have just set out from Southend, Essex, airport in a small private aircraft for a 22,000-mile tour of the African continent on a flying sales drive. Their mission: To sell to Africa the equipment and services of the Balfour Group of Companies, Leven, Scotland, an international concern with a world-wide reputation in the development, design and manufacture of chemical process plant.

Ronald J. Hannaford and Gordon Pearce have been sales engineers with Balfour for five years and have extensive experience of selling chemical plant to export markets. Both know Africa well. Hannaford, who holds a pilot's licence, will be at the controls of the aircraft, and Pearce will assist on navigation and radio operation.




### Technical Know-how

Hannaford and Pearce have long felt that their Company possessed the exact equipment and technical know-how to offer to the African continent, with its vast expanding economy, for the development of important local resources, particularly in areas which are extending rapidly, and in others where self-government has already arrived or will soon be established.

They put up the self-service idea to Mr. I. M. Hutchison, Joint Managing Director of the Group. He gave them his immediate and keenest co-operation and backing.

Technical data in respect of each associated Company was compiled and tabulated by the various experts concerned for ready reference on the tour, but if the men are able to interest any firm in a really big project, specialists from Balfours will fly out to provide additional information for on-the-spot discussions.

Advance appointments have already been arranged in 18 key towns, including Freetown, Lagos, Nairobi, Salisbury, Johannesburg, Bloemfontein, Port Elizabeth, Cape Town, and Leopoldville. The Board of Trade are also enthusiastically supporting this trip and have fixed interviews with government officials in South-west African territories.

The aircraft, which will be marked Balfour Group of Companies, Scotland and England, is a single-engine, four-seater Percival Prentice. It has a range of eight hundred miles and will enable the men to make extra trips, if necessary, hundreds of miles off their main route.

## Apprentices' day

Gas-fitting apprentices in Edinburgh and South-East Scotland displayed their handiwork at a recent exhibition in the Scottish Gas Board's Edinburgh training centre. Mr. G. J. B. Cox, Divisional Deputy General Manager, presented prizes and certificates.

## Power-Gas Corporation gets semi water gas plant order from Spain

THE Power-Gas Corporation, Ltd., of Stockton-on-Tees, has received an order for a semi water gas plant, having a productive capacity of 5,000 cu. m. per hour (189,000 cu.ft. per hour) of $CO+H_2$ from coke, from Societá Iberica de Nitrogeno of Madrid for their Felguera works.

The plant will comprise an 11 ft. 6 in. internal diameter water-sealed generator with combustion chamber and waste heat boiler. The cyclic operation will be controlled by the P-G automatic controller which incorporates features of Lockheed equipment. The plant is arranged for extension and will be additional to the oxygen blown producers which the Power-Gas Corporation Ltd. supplied to this company in 1949.

### Another Holder

Ashmore, Benson, Pease & Company, a member of the Power-Gas Group, has recently put into commission a 3 mill. cu.ft. A.B.P. Klonne-type dry gasholder at a large iron and steel works. The holder, which incorporates an automatic system of lubrication designed to improve the distribution and reduce the consumption of grease, will be used to store blast furnace gas.

This is the sixth holder of this type completed by the Company for iron and steel works since the war and a further five are in course of manufacture. Capacities have ranged from 1 mill. to 5 mill.

## Ascot-Ewart publicity

The Group publicity department of Ascot Gas Water Heaters Ltd., and Ewart & Son Ltd., is now at 143, Sloane Street, London, S.W.1. Telephone Sloane 5276/7.

## Eire finds it cheaper to ship coal from U.S.

### *£2 5s. A TON SAVING OVER U.K. IMPORTS*

THE Dublin Gas Company expects to save £2 5s. a ton on coal as a result of a recent agreement with Irish Shipping to import 100,000 tons of American coal to replace previous imports of British coal.

During the past two years Irish coal imports from Great Britain have fallen by 44%, from 1.8 mill. tons in the 12 months ended June, 1956, to 1 mill. tons in the 12 months ended June, 1958.

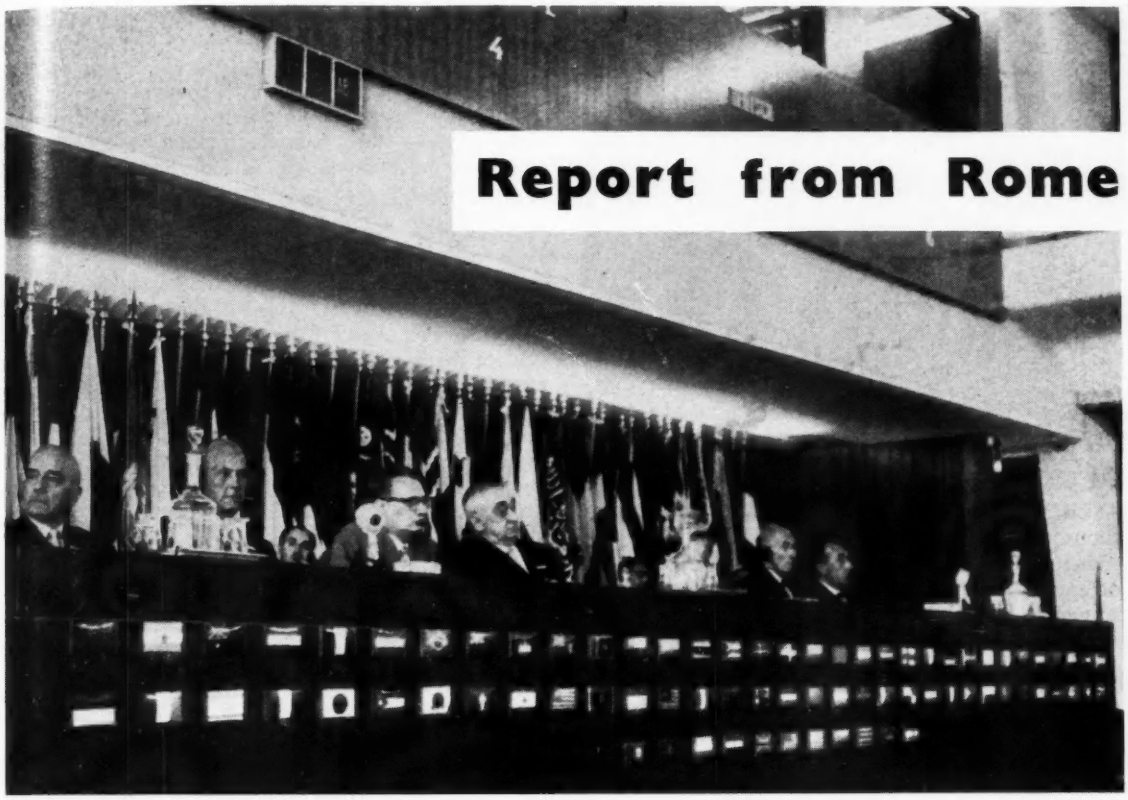
The bulk of this decline has been attributable in part to the substitution of oil for coal as the principal source of motive power on the Irish railways, which are now almost completely operated by diesel traction. It has also been due to the substitution of peat, and to a lesser extent oil, for coal as the principal fuel in the Republic's steam-driven power stations—the cost of British coal for this purpose now being prohibitive.

Another factor, however, has been the growing volume of imports of American and Polish coal. In the first half of 1957 these imports were limited to 17,000 tons, but between January and June of this year 180,000 tons of such coal was imported—almost 30% of total coal imports. The U.S. supplied 134,000 tons and 46,000 tons came from Poland.

The Dublin Gas Company's decision involves the substitution of chartered shipping for the Company's own fleet of cross-Channel colliers.

## *Contract awarded*

Contract for the disposal of the British industry pavilion, which has already attracted 4 mill. sightseers at the Brussels Exhibition and won acclaim as a masterpiece of modern structural engineering, has been entrusted to George Cohen Sons & Co., Ltd.



# Report from Rome

## SEVENTH INTERNATIONAL GAS CONFERENCE REVIEWED

FAO—the United Nations Organisation for Food and Agriculture—has provided itself with a magnificent administrative block of modern buildings in the Viale delle Terme di Caracalla, Rome; and that was the venue for the 7th International Gas Conference, the hard core of which was dealt with from September 25 to 28. There can be no argument that the accommodation is not ideal for such a gathering. There are the vast Plenary Hall and two lesser, but still palatial, apartments all in modern but restful décor; each armchair fitted with its 'mike' and so comfortable that to drop asleep would seem to offer insult; crystal carafe and glasses for every four delegates (welcome indeed with temperatures playing around the 80 mark); noiseless doors and deep carpeting to facilitate the exits and entrances which must be continuous when parallel sessions are the order of the day. Add to this a snack bar and withdrawing rooms, a bank, an airline office, several shops, and an eighth-floor restaurant opening on to a roof-space whence half Rome and the surrounding country can be viewed. Such is the FAO Building; to get there from the hotel quarter of the city is a worthwhile hazard, whether by sardining in a tram, jay-walking the charging lines of traffic, or by reasonably priced taxi which, for some unaccountable reason, seems never to collide with anything.

Since the last conference, in 1954 in New York, Rumania, and Russia have been admitted to membership of the Union, which now numbers 19 countries. In effect 20 countries sent delegates to Rome and there were also representatives of four European economics organisations.

The list of delegates showed the record attendance of nearly 550 men and 280 wives and daughters. Of this total Great Britain arrayed a force of 124 and 72 respectively—around a quarter of the total, which seems to indicate that we still represent a keen and cohesive industry.

Our numbers included the President of the Institution (Mr. E. M. Edwards) and the Immediate Past-President (Dr. James Burns), and the Institution's representatives on the Council of the I.G.U.—Mr. J. H. Dyde and Mr. W. K. Hutchison (both of them Past-Presidents of the I.G.E.). Viewed from the very slightly different angle of nationalised gas, we will record the presence of Sir Harold Smith (Chairman, Gas Council) and no fewer than 16 chairmen, deputies and members of area boards. On every subject among the reports and papers the British delegation could, and did, put up a team of experts. From the manufacturing side and the oil industry there were some two dozen British delegates.

### Visits

Rome was approached by many diverse routes and means, many people making holiday on the way; but the Union had arranged a number of technical visits in the north of Italy, in particular to the 'Emilia' thermo-electric power station, the Fiat and Montecatini works, the 'Cokitalia' coke works, the 'Dalmine' factory, the San Donato Milanese (Metanopoli) and the ANIC

*The Green Room, one of the two lesser halls in the FAO building, showing the interpreters' boxes.*

(Azienda Nazionale Idrogenazione Combustibili) installations.

There were also laid-on a selection of four post-conference tours lasting from three to six days, but we are unable to report to what extent these were patronised.

### Entertainment

After registering on the Wednesday, there was a sight-seeing tour of selected wonders of the city, and the following evening participants visited the Capitol and were received by the Mayor of Rome; the weather remaining warm and dry. On Friday evening there was a very largely attended dinner and dance at the Excelsior Hotel, and on Saturday evening a concert in the auditorium of the Italian TV headquarters.

An excursion on Sunday afternoon to Villa d'Este and Tivoli was preceded by a delightful open-air luncheon offered by the Rome Gas Undertaking.

Meanwhile a special programme had been working out daily for the ladies.

### Pontifical Audience

Of outstanding interest, and an event which gave great satisfaction to the large numbers who attended, was the audience granted by His Holiness at Castelgandolfo early on the Sunday morning. He gave, during an address of perhaps 15 minutes in length, further proof that he is a man not only of religion but of world affairs. We deal more fully with his address elsewhere in this issue.

### Opening Session

There was a very big attendance of delegates and ladies in the Plenary Hall for the opening session, with the retiring President, Dr. Mario Boselli, in the Chair. A speech of welcome was made by Dr. Vittorio De Biasi, President of the Italian Gas Association, after which the Under-Secretary of the Ministry of Industry and Commerce spoke a few words and declared the conference open.

Dr. Boselli then gave an address in which he reviewed the developments which had taken place during his three years in office, including atomic energy and new gas making processes, and considered the position of the gas industry in the framework of world energy requirements.

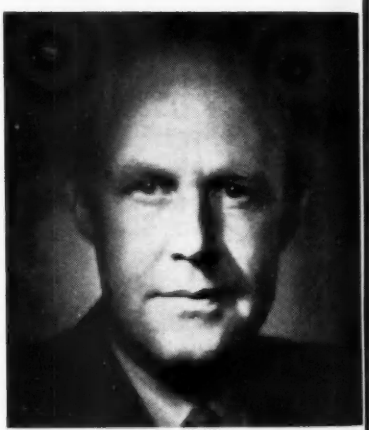
### 1958-1961

The new President of the International Gas Union is Mr. Bengt M. Nilsson, General Manager of the Stockholm Gas and Water Works and at the moment President of the Swedish Gas Association. The announcement was received with applause and general satisfaction. The 8th International Gas Conference will be held in Stockholm from June 28 to 30, 1961.

Also elected for the three-year term were the following Vice-Presidents: Prof. Brender à Brandis (Belgium) and Messrs. P. Dorzée (Belgium), J. H. Dyde (G.B.), P. Mougin (France), M. Schenker (Switzerland), L. Stoll and W. Wunsch (Germany).

M. R. H. Touwaide was reappointed General Secretary; and Mr. Claes Lindgren (Stockholm) has consented to act as President's Secretary.

**NEW PRESIDENT**



**Mr. Bengt M. Nilsson**

### Interpreter Service

During votes of thanks at the closing session, perhaps the most hearty applause went to the management and ladies of the interpreter service which was quite admirable. In both halls speakers could use English, French, German and Italian. In one hall they could listen in those same four languages; in the other in French and Italian. On this occasion the highly qualified ladies were defeated only by the worst gabblers.

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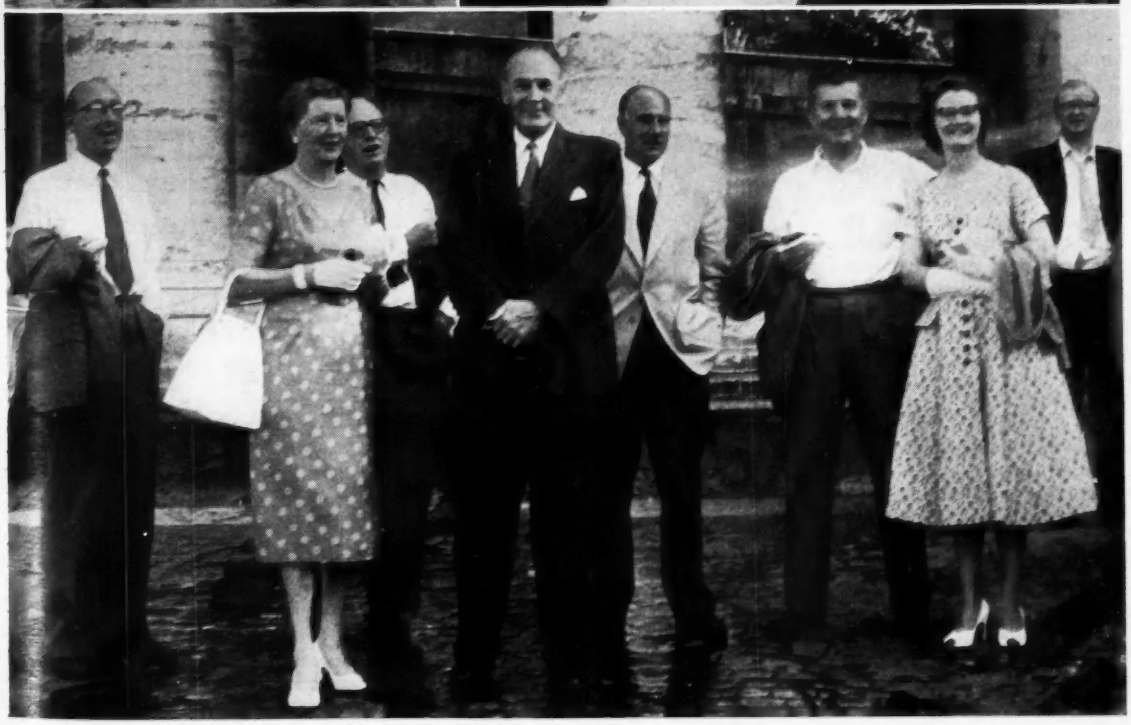
**The first instalment of our review of the proceedings of the 10 Technical Sessions appears on p. 66 In our preparation of this we are greatly indebted to the collaboration of Mr. C. D. SHANN, M.A., M.INST.GAS E., Manager of the Overseas Gas Division of William Press and Son, Ltd.**

# Roman Holiday?—Well, Some Lighter Moments

*Top Left:* Mr. W. K. Hutchison (Past-President I.G.E. and Chairman S.E.G.B.) with Dr. A. E. Haffner (Chief Engineer S.G.B.) in St. Peter's Square.

*Centre:* Lunching at the Villa Borghese. Our group includes Mrs. R. S. Edwards and Miss Edwards, Mrs. L. W. Andrew, Mr. and Mrs. A. R. Bennett, Mr. R. M. Munns, Mr. G. H. Fuidge and the Hon. Secretary I.G.E. (Mr. George Currier).

*Below:* Mr. D. L. Copp, Mr. and Mrs. T. W. Gibson, Mr. P. McDiarmid, Mr. and Mrs. T. S. Ricketts.



# The Pope's Address to I.G.U. Conference

SUCH a gathering as yours, Gentlemen, could not be overlooked by Us. You know very well how much we are interested in all the human problems, in everything that concerns social life and scientific progress. It is good to see man working under God in order to organise the world, always exploiting new resources which he discovers in the vastness of the universe. He thus makes available to his brethren an ever-increasing quantity of energy, and if they follow the dictates of the inner law governing spiritual progress He enables them more and more to have the control of matter and to liberate themselves from limitations of evil, by gaining more freedom in the service of the truth, of beauty and the universal good.

Long ago, the use of gas changed from lighting to heating and numerous industrial applications. However, in each of these fields, the competition of oil and electricity has led to new markets and stimulated research. In more recent times, the use of natural gas has become a challenge to the gas industry, while the chemical processing of hydrocarbons became a new source of fuel gas. Far from just opposing these new rivals, your industry joined forces with them and you studied carefully the best ways of jointly meeting an ever-increasing demand from your consumers.

On the other hand, it looks as though the mining of the European coalfields, often at great depths and costlier to achieve, will sooner or later make it necessary to use lower grades of coal and, consequently, new methods and processes. In addition to these general questions, technical problems play a most important part in the work of your Conference. They arise one year after another—for instance, the discovery of plastic materials, long distance transport at high pressure, the considerable fluctuations of consumption due to heating during the winter, and the call for new methods of storage. The research papers, so carefully prepared and so well presented, which we have received, bear witness to the high quality of your work.

Another research subject of yours, which has had Our particular attention, is the safety of workers and consumers. The problem is as old as your industry and much research into it has been carried out, but there are new aspects now that it is standard practice to use certain gases which are practically odourless. And you will appreciate that the moral aspects of this problem are causing Us to talk about them. It would be inadmissible indeed if for purely economic reasons the solutions, and even partial ones, which science provides today were to be ignored.

Unfortunately, the risk of explosion cannot be completely avoided where fuel gas is used. But the knowledge, which should be as accurate as possible, of the behaviour of a given gas enables us to foresee and eliminate most of the risks inherent in the working of holders, pipes and equipment and also when we either put them into, or take them out of, service. Legislation and internal regulations also contain the best possible provisions. However, we appreciate that this risk, just as that of poisoning, becomes all the greater if no noticeable odour draws our attention

to the presence of gas, and this is usually so in the case of the purified natural gases from underground sources.

This fact has led to research into the odorisation of gases. On principle, the admixture of odorous gas to one which is odourless does not present any major difficulty, but the creation of conditions which must be satisfied by the detecting gas has been found a very complicated problem. Nevertheless, the presence of a dangerous quantity of carbon monoxide in the atmosphere is a risk that must be made noticeable by all possible means. And it seems that odorisation is at present the only one likely to work in most cases.

There could be a more radical solution. If we think of the sad way in which too many people in despair are still using gas to end their lives and of the fatal accidents caused by leakages of gas, especially during the night, it becomes Our ardent desire that something be done—namely, the manufacture of domestic gas that is not poisonous. We have been assured that a certain price increase would enable a considerable reduction of the risk of accidents by lowering the carbon monoxide content to about 1%. Such a measure obviously calls for economic guarantees which only the public authorities can provide; but it is of such importance that it is their duty and responsibility. We hope that all those on whom we rely for the solution of this problem will tackle it in the knowledge of performing a social service and will be able to remove a drawback which still affects the use of a fuel which is otherwise so useful and convenient.

These considerations take Us back to the thoughts expressed at the beginning of this address: Man is by nature compelled to make continuous progress. To him, stopping means going back. He must advance; he is on his way towards new horizons all the time and towards syntheses always growing in extent. He is in search of the fundamental explanation which will show the oneness of all things. Thus, the scholar's search usually leads to the worship of Him on whom his inmost existence depends and whose awe-inspiring works reveal to him "the eternal power and God himself" (Rom. 1, 20). May this essential truth enlighten and fortify your hearts in your daily work. May it also transform your hearts for yourselves to see, for in organising the world it is not your duty to build a final city on earth but to facilitate for yourselves and your fellow-men the only research and discovery that matters—that of God.

In expressing these wishes before the Lord of the Universe, We beg Him that your recent stay in Rome may mark a stage in the progress of your spiritual life. May trust in God sustain you and be with you in the various countries to which you are going back. And so that this prayer may all the more certainly be granted, and as a sign of Our benevolence, We bestow on all of you here assembled, your families and all those who are dear to you Our Paternal Apostolic Blessing.

I.G.U. ROME—
'Gas Journal' Abstract

SESSION I A

# Review of Technical Sessions

**IGU/5-58 Total Gasification of Coals.**
*Report by the German Association.*

**IGU/9-58 Special Technical Problems in the Transport of Manufactured Gas over Long Distances at High Pressure.**
*Report by the French Association.*

**IGU/11-58 Development of the Use of Petroleum Products in Town Gas Manufacture.**
*Report by the Institution of Gas Engineers.*

**IGU/40-58 Telemetering, Control and Automation in Gas Pipeline Operation.**
*Paper by N. H. M. Tychon, Distribution Chief, Staatsmijnen in Limburg, Geleen, Netherlands, in collaboration with E. H. L. Niessen and J. A. Fox.*

## COMPLETE GASIFICATION

THE essential problem which the many techniques in the complete gasification of coal attempt to solve is the up-grading of the 'lower' grades of coal—'lower' from, in the main, two characteristics, volatile content and physical grading. Many of the processes, realised or projected, are successful technically, but whether they are economically feasible depends on cost factors which may vary widely, locally. The report of the 'Working Party of the German Gas Industry,' by Herren K. Traenckner and H. W. von Gratowski, is a factual statement covering the whole field of these techniques from their technical aspects only. It opens with a summary in the form of a classified list of the known processes and closes with a formidable bibliography of 95 publications on the subject.

Processes are classified under three main headings—the gasification of 'lumpy and coarse' coal, fine coal, pulverised coal.

### Limited Range of Coals

In the first class are those in which heat is obtained by the partial combustion of the coal in a producer. The most numerous in operation are those run cyclically in two stages—the heating up (the 'blow') and the production stage with steam (the 'run'). The range of suitable coals is limited. In the most widely used in Great Britain, the Tully plant, partial carbonisation is effected in one or more retorts superimposed on the producer. The GI-VIAG is equally widely used over the rest of the world with one notably large plant in Japan, which however appears to have suffered the fate of some of the earlier Tully plants—it was put to work on local coals but, encountering difficulties, it was 'transformed for the production of water gas from coke.'*

Oxygen has been used in two installations of the GI-VIAG design to give continuous operation.

The main defect with these and other processes using steam and air is the low calorific value of the gas produced. In order to produce town gas, a process must respond to two requirements—'it must produce a gas low in $CO_2$ and $N_2$; the volatiles contained in the coal must be conserved as far as possible.' To meet these demands the use of oxygen in place of air has been proposed, with or without pressure. Dr. Dent has dealt fully with these propositions over the last few years. Processes using air can meet the demand by the use of some form of enrichment.

### New Proposals

Some new proposals are outlined with diagrams in the report and the important plant at Morwell (Australia) for the gasification of lignites is briefly described. Processes are mentioned using external heating of gasification chambers constructed in steel with water jackets.

Fluidisation processes for the gasification of fines, mostly of lignites, are described—notably that of Winkler with a diagram of the producer. For the gasification of pulverised coal, in which oxygen is used, we have the processes of Koppers-Totzek, Babcock and Wilcox and Texaco in the U.S.A. It is the last-named which is to be used by the North Western Gas Board.

Perhaps the most interesting section of the report is the final one, 'Conjectures on Future Developments.' In spite of the advances of the last 20 to 30 years, 'the number of processes proved successful on the industrial scale remains relatively small.' Natural gas and petroleum products are ousting coal from its dominant position in many countries. 'Only those which dispose of

* It appears, however, from IGU/21-58 that this plant is definitely designed for the gasification of either coke or coal.

cheap coal or which seek to restrain for economic reasons their imports of petroleum, remain *for the moment* strongly interested in the gasification of coal.' Mention is made of the proposal of the West Midlands Gas Board for a large Lurgi plant to gasify high-ash coals under pressure. 'Also, the Scottish Gas Board has pronounced itself favourable on the chances of gasification under pressure in its region'—a curious inversion of the true position! In Germany the production is still tied to that of coke. Here and even in America, in spite of the impact of petroleum, these writers foresee a big development in the gasification of coal in the course of the next 20 years.

The future is not yet clear. 'There is no doubt that the gasification under pressure of small coals, using oxygen-steam, will remain in the framework of the perspectives of economic integration by way of large networks of transmission of gas over large distances.'

### DISCUSSION

The report was introduced by the co-author, Herr K. Traenckner who made the point that the future for coal gas appears to lie with pulverised fuel, plus oxygen and steam.

Mr. H. D. GREENWOOD (G.B.) opened the discussion by saying the report made a most welcome addition to the information on the subject. It was useful to have the processes for complete gasification classified according to sizes of coal.

As the capital cost of plant was high and coal cost relatively low, it was important to have a good load factor for the operation of this type of plant. It was generally cheaper to transport gas than coal except over distances of a few miles from the coal source, and even then it was uneconomical to transport coal having a high ash content.

In Great Britain 'small' coal was taken as being the sizes under 12 m.m. but the Lurgi plant would not tolerate sizes less than 4 m.m. and these represented about 50% of the small coals. It was therefore necessary to find an outlet for these smaller sizes, which might be either by power generation or gasification in a slagging generator which could be operated in conjunction with a Lurgi plant. Mr. Greenwood referred to the work done by the Gas Council Research Station.

Mr. G. le B. DIAMOND (G.B.) explained that the construction of a Lurgi plant in England had been delayed due to the long negotiations which had taken place with the town and country planning authorities on the subjects of siting and effluents. He noted that experience in Germany had been in the direction of minimising capital charges and economy in stand-by plant. He questioned whether the authors would have changed their thoughts on purification plant in the light of recent developments in the processes available. He also raised the question as to the use of liquid or gaseous oxygen.

Mr. Diamond said that the fuel economy of Great Britain is still essentially dependent on coal. Small coal would be increasingly available, and this demanded high-pressure processes.

## GAS MUST PASS A 'THRESHOLD'

The Association Technique de l'Industrie du Gaz en France issued to member nations a questionnaire on the particular technical problems arising in the transmission of manufactured gas over long distances at high pressure.

Replies were received from the relatively few countries where this technique is practised—Germany, Belgium, Holland and France in Europe, and the United States of America. In all cases, experience leads to the same basic conclusion—that before, during and after its compression, the gas must be so processed that it is subjected, before entering the transmission lines, to conditions of pressure and temperature worse than those it will encounter during the whole of its journey. It should be made to cross a pressure and temperature *threshold*.

The replies set out the methods used to attain this object and also dealt with purification processes. They emphasised the necessity of obtaining as low a dewpoint as possible.

The gases dealt with fall into the two categories, gases obtained from the carbonisation of coal (more or less mixed with peak load gases of various kinds), and those obtained wholly from the treatment of petroleum products.

It is important that all gases for transmission over long distances at high pressure should be in such a state of chemical purity and with such physical properties that there shall be no risk of liquid condensation or solid deposits during transit. In spite of all precautions of this nature there are risks of the deposition of dust, particularly at the starting-up of a new network. These can be guarded against by the use of inhibitors, injections of alcohol, augering (cleaning of pipes) and filters. At pressure-reduction points the gas must sometimes be heated to prevent the formation of ice.

### DISCUSSION

M. A. AMSLER (France), in his introduction of this report, mentioned that there had been further developments since it was compiled in the autumn of 1957.

DR. A. BOHM (Italy) asked if there was a 'dangerous' velocity for gas in a pipeline.

M. AMSLER replied that it was difficult to say. On one occasion a hole had occurred at a bend in a pipeline after only a few hours operation. This was attributed to the high velocity of the gas, although this had not been measured. There had also been dust in the pipeline and this, coupled with high velocity, may have caused the failure of the pipe. The introduction of filters improved the situation.

## PETROLEUM IN GAS MANUFACTURE

The Institution of Gas Engineers produced the survey of developments in the use of petroleum products in gas manufacture. The report did not include the U.S.A. because the A.G.A. submitted a comprehensive report to the Sixth I.G.U. Conference.

After dealing briefly with the use of oil for heating carbonising plant (no major extension likely in G.B.) and the carbonisation of oil-coal mixtures, the report reviews the use of petroleum products other than gas-oil in C.W.G. plant. Compared with gas oil, the use of heavy oil gives a reduction in output while lighter fractions give increases in output ranging from 20% to 30%.

Plants for the gasification of petroleum products involving catalytic processes are on the increase, and typical data are given for the better known designs, both catalytic and thermal. Most of these use heavy fuel oil,

but experiments with other grades have been made and all fractions can be successfully used.

*There are more large oil gasification plants in Great Britain than anywhere else*, the total capacity being uncertain. Outside Great Britain, Japan is the largest user of oil for gasification, consuming nearly 1,000 tons per day producing nearly 10% of all gas made.

In the majority of the countries examined, there is a steady growth in the quantity of petroleum products gasified annually. There is a growing tendency to instal base-load plant for the gasification of these products, because of the low capital charges compared with coal-gas manufacturing plant. Where plants can be installed in conjunction with a refinery, optimum economic conditions obtain for the installation of oil-gasification plants. Where the light fractions are dealt with, there is not only a gain from lower sulphur contents and hence reduced purification costs, but outputs from plants are enhanced.

## DISCUSSION

MR. E. M. EDWARDS (President, I.G.E.), in his introduction, mentioned that there had been many developments in the use of petroleum products in Great Britain, particularly in the use of refinery gas and liquid petroleum gases since the report was compiled in the autumn of 1957, and several speakers who were to follow him would give further details. He said there was need for more knowledge of catalyst behaviour.

MR. J. E. DAVIS (G.B.) said the speed of development was so great that it was difficult to know more than what was under one's own hands. His Board was concerned with two kinds of plant. First, existing water gas plants using light ends from petrol refineries and, secondly, new plants using surplus oil product feedstocks, of which they would have two types—the now well tried SEGAS plant and another one they were shortly to construct which would produce a non-toxic low-sulphur gas under pressure.

DR. JAMES BURNS (G.B.) said: It may be that Great Britain with her tremendous natural resources of coal has been rather slower to develop the use of oil and oil products as raw materials for town gas manufacture, but the situation in this respect has altered very materially over the last three to four years with the great technical developments in the oil industry, coupled with the increasing costs of coal production and coal transportation.

### *Space Heating Load*

Great Britain, however, very early recognised the potentialities of oil as a raw material appearing in a highly concentrated and easily handled form and where the plant employed for its conversion to gas could be much simpler than the plant used for coal. Thus, as far back as 1890, oil became a preferred raw material for the provision of gas required at relatively short notice and in unequal daily or weekly amounts; it also proved of great value as a raw material for gas production for the space-heating load. There were developments, especially in the post-war years, of the use of oil and oil products for an even more refined application—namely the production of gas for high peak purposes, and by this we mean the load which is likely to occur for only 30 days per annum or less. In this we found oil, used in the very simplest form of gasification plant, suitable for addition to normal town gas. Even this could prove too expensive for high peak purposes, and latterly we have gone over to the use of stored propane/butane as a ready-made raw material for admixture for high peak purposes.

There is an economic balance between raw material costs and capital charges on plant, and an analysis of this balance is required to determine which type of raw material shall be used to supply any particular load. The high concentration of therms in oil, coupled with the relatively cheap plant required for its conversion, is likely, in my opinion, to continue to give oil great advantages in the production of seasonal and peak load gas for the future. This position is likely to hold until such time as we can develop a form of underground storage which will allow base-load gas to be manufactured all the year round, with the drawing-off of seasonal and peak load supplies as required.

### *Base Load*

I would like to deal, however, quite shortly with some experience which we have gained on the use of oil and oil products as raw materials for base-load gas production. Under the present economics of coal production and transportation in Great Britain the costs of coal delivered to the point of usage are such that it is economic in some cases to use oil or oil products as raw materials for base-load production. This is the case in the London area, which is remote from the coalfields but close to the major centres of oil importation and crude oil processing. We have some experience of the Onia-Gegi and Segas processes, and these have, in broad aspect, come up to our expectations.

There is still work to be done on the development of catalysts which will give a life matching the load factor which one can normally expect on a plant of this type, and that is a load factor of 90%. The catalyst requirements are, of course, activity to allow of operation at a reasonable temperature, physical strength to withstand the conditions met in alternating blow and run, together with the appropriate size and shape which will give the minimum back-pressure through the catalyst bed. There is still work to be done on catalysts for this type of plant.

I would not say, however, that the Onia-Gegi or Segas type of unit is likely to be the unit of the future for they are still, in my opinion, too small in size of unit; and with the greater degree of centralised gas manufacture which the gas industry in Great Britain must experience if it is going to survive, we should not look at any unit size less than 10 mill. per day, and the maximum size can be much greater than this.

It is clear, too, that the gas of the future should be free from sulphur and with a controlled amount of carbon monoxide, which is not so easily possible from the low-pressure type of gasification process.

### *Refinery Gas*

We have some experience on another base-load process using oil products, in the form of a plant for the conversion of refinery gas. By an agreement completed between the Shell Refinery Company and the North Thames Gas Board, we undertake to accept from the Company 25 mill. therms per annum of refinery gas. This was the bare bones of the agreement, but there were many details requiring correct decisions if the agreement were to be beneficial to both parties. The first point to be decided was the site of the reforming plant, and it was decided to carry the rich gas as far as possible into the heart of the Board's existing grid to get the benefit of lower transmission costs. It was decided, too, that the gas should be purified from $H_2S$ and its organic sulphur reduced to very small proportions at the refinery site. This enabled us to use a steel main operating under high pressure up to 400 lb. per sq. in.

The great requirement, however, was reliability, for on a project of this size the costs could be right out of court

if we had to supply stand-by plant and men to take up gas manufacture in the event of failure. Thus our agreement with the Shell Company was directed to the highest possible incentive to reliability on the part of Shell to supply us with the gas and on our part to accept it at all times. We took this a stage further in the provision of a type of plant for the job of transformation which could use other raw materials; and the most suitable raw materal was primary flash distillate, which could be stored on the site and used in the event of complete failure of the refinery gas supply. There are provisions for annual shut-downs with a complete cessation of gas to allow both the refinery and ourselves to carry out annual repairs and maintenance; a schedule of repair and maintenance was developed for the plant which would allow maximum reliability.

### Line Packing

Additionally, both parties to the agreement had the benefit of line packing on the 17-mile main where a supply of gas lasting for approximately 5 hours can be stored. This plant went to work on May 6 this year with a three-month period in which both parties could use the occasion to learn how to do the job without obligation or penalty to the other party. The period was well used on both sides and at the end of three months precisely the agreement proper came into operation and has been operating with a high degree of satisfaction ever since.

### 25-30 Mill. Cu. Ft. a Day

The plant was built by Humphreys & Glasgow Ltd., and consists of 4 units each designed to produce 9 mill. cu.ft. per day of 500 B.t.u. gas. In fact, the actual capacity is a good deal higher than this and we have already produced up to 24 mill. cu.ft. per day from two units. All our figures for operating efficiency are in the region of 90% and we expect this plant to continue to provide the Board during this coming winter with anything up to 25/30 mill. cu.ft. of 500 B.t.u. gas per day. It will reach full capacity within the next year or so when a similar agreement, which the Board has made with the Mobil Oil Company, comes into operation. The gas is completely free from sulphur. Its specific gravity is in the region of .52 and it has combustion characteristics suitable in all respects for the district the plant serves. The carbon monoxide content varies with the calorific value of the feed gas, but is in the region of 12%.

### Statutory Sulphur

The operation of this plant has shown, incidentally, how absurd the statutory regulations for sulphur can become. The gas at inlet to this plant is free from $H_2S$, contains only a minimum of organic sulphur and would constitute a first-class gas from the total sulphur point of view. On passage through a plant the organic sulphur compounds are converted to $H_2S$; and although the total sulphur is even less than it was at inlet to plant this gas does not meet statutory requirements and it has been necessary to add an expensive sulphur purification unit at the outlet.

It is recognised that the availability of refinery gas in the country as a whole is not very high for it is limited by other processes. Nevertheless, here is a great potential energy in a highly refined form which the gas industry can make suitable to the particular requirements of its consumers. Furthermore, this form of operation gives us great experience for the potentialities and possibilities of dealing with natural gases as these come along.

### N.W.G.B. Plant

Mr. W. HODKINSON (G.B.) gave a detailed description of the plant being constructed to Dr. Dent's design at Partington. He said this was a good example of full-scale experiment being undertaken by one gas board on behalf of the Gas Council to provide experience from which all the boards would benefit. The plant, employing the Texaco process, had three basic features:

1. Production of hydrogen.
2. Conversion of carbonaceous material to methane.
3. Purification of the gas to make it suitable for supply to the public.

The plant should be ready by March, 1960, and would produce a gas low in CO, sulphur free, gum free, at 450 p.s.i.g.

## AUTOMATION IN PIPELINE OPERATION

A gas transport system has to serve consumers with differing requirements. Gas sales fluctuate considerably from day to day and week to week. The consequent load fluctuations are not compatible with the most economic use of production units, compressor installations and the pipeline system. Fortunately the compressibility of gas makes it possible to level-out the load fluctuations to a considerable extent by the use of ' linepack ' (defined as ' the varying difference between the effective total storage in the grid and the quantity which would be contained in it if flow were constant '). Pressure variations in the grid can be represented by a differential equation which can only be integrated by iterative (trial and error) methods. These are very lengthy and several investigators have approached the problem by means of models (see I.G.U./30-58). The adoption of a computer for transport analysis is therefore considered.

The first step towards automation in the operation of a pipeline will be the measuring of pressures and quantities at several characteristic points. These data are transmitted to a central Supervisory Centre where they are interpreted by a despatcher. If the despatcher has means at his disposal for taking remedial action by remote control, we may speak of a telemetering and telecontrol system.

A system of this type, used by the Dutch State Mines in Limburg, is described (with map and diagrams) in this paper.

At a given stage of development the situation may become such that it no longer suffices to make simplified calculations and correct them by means of telemetering and telecontrol. It will be then necessary to make an accurate gas transport analysis by means of computers, the introduction of which into the system opens the way to complete automation. Automation should be introduced in several steps. The paper gives some suggestions on this point. An Appendix sets out the derivation of the differential equation, describing the pressure variation in a non-constant gas flow through a pipeline.

## DISCUSSION

M. A. RENAULDON (France) said they had tried a digital computer but it had taken too long to give results in time to effect the desired control operations. They had also tried the electrical analogue computers, but these were very expensive. Studies were being continued with digital computers.

DR. TYCHON (Holland), in his reply, said that in Holland they had three systems operating at different pressures and a simple method of control was no longer sufficient. Therefore the use of telemetering was introduced.

I.G.U. ROME—
'Gas Journal' Abstract

# SESSION I B

**IGU/1-58 International Statistics of the Gas Industry.**
*Report by the Belgian Association.*

**IGU/24-58 Safety Regulations for the Prevention of Gas Explosions.**
*Paper by Georg Rasmussen, Works Manager, Eastern Gasworks, Copenhagen.*

**IGU/37-58 Two Years' Experience in the Use of Refinery Gases at Naples Gasworks.**
*Paper by Dott. Ing. D. E. Galanti, Cia. Napoletana Gas, Italy.*

**IGU/33-58 Chemical Engineering Principles Applied to the Cooling and Purification of Manufactured Gas.**
*Paper by G. Dougill, M.Sc., M.Inst.Gas E., F.R.I.C., Planning Engineer, and E. Spivey, Ph.D., M.Inst.Gas E., A.M.I.Chem.E., Senior Chemical Engineer, North Thames Gas Board.*

## INTERNATIONAL STATISTICS

THE issue of these statistics by the International Committee, under the Chairmanship of M. R. H. Touwaide, is the fourth in the series begun in 1949. The years covered in the present issue are for 1954, 1955 and 1956. Permission was granted by the O.E.E.C. to quote in extenso from tables in its first two Annual Bulletins of Gas Statistics in Europe, which makes this document the most complete and up-to-date of its kind available in the world.

### DISCUSSION

Mr. J. H. DYDE (G.B.), who was Chairman of this session, pointed out that this was the fourth successive report at these triennial conferences. Each report had been larger and more informative than its predecessor, and the latest could rightly be claimed the most complete document to date of basic information about the gas industry throughout the world.

The reporter needed no introduction. He was none other than the much respected and tireless Secretary of the I.G.U. As Chairman of the I.G.U. Statistics Committee since its inception, he had been the chief architect of this considerable work. They owed him and the members of his Committee a great debt of gratitude.

Mr. D. TINBERGEN (Holland), after M. Touwaide had surveyed the report, put forward one or two suggestions for amendment, concerning chiefly the method of classifying undertakings.

Mr. J. H. DYDE (G.B.) pointed out that the international statistics of the gas industry published by the I.G.U. did not now represent the only series, for the Economic Commission of Europe were publishing an annual bulletin and O.E.E.C. had published considerable statistics in their economic report entitled 'Gas in Europe.' It was good to see that close co-operation had been maintained between the Committees of these organisations and the I.G.U. Committee. If basic statistics continued to be published by all these bodies it was essential to establish a common basis of presentation.

As the gas producing industries covered a much wider field than the gas industry proper, it was suggested that the four-fold analysis dealing with production and availability used in the annual bulletin of Gas Statistics for Europe be reconciled with the six-fold analysis used in 'Gas for Europe,' and that in future all tables of international gas statistics be allocated a code number or letter to indicate the sectors of the gas producing industries to which they related.

It was equally important to know which sectors of the gas producing industries formed the vehicle of sales to the public. In Great Britain no problem arose in this connection, since all sales to the public were made through the nationalised gas industry which would be described as the 'gas industry proper' under either of the two classifications mentioned above.

He, Mr. Dyde, had always been against the I.G.U. entering the commercial and economic field as far as discussion and deliberation of policy were concerned, adhering strictly to their brief of technical and scientific development; but he saw no harm in using the I.G.U. Statistics Committee as a vehicle for collecting and collating consumer and market statistics. The greatest scope for improvement and extension appeared to lie in the field of commercial and market research (or 'market information') statistics rather than in production statistics. It was a curious fact that the publications of other bodies did not include any statistics relating to numbers of consumers, although, on the other hand, they had made a step forward by showing certain figures in teracalories rather than cubic metres, so that comparisons could be made on a thermal rather than a volumetric basis.

He suggested that, in addition to the annual sales per consumer (shown in Table IX), separate averages should be calculated for annual sales per domestic consumer. This was a figure to which considerable importance was attached in Great Britain, where average sales per domestic consumer had begun to decline. It was not, however, suggested that the average sales per industrial consumer should be shown, since the figures would vary considerably according as to whether numbers of meters or numbers of consumers were used in the calculations. In the case of domestic consumers, results obtained by using 'consumers' or by using 'meters' as the divisor should not differ appreciably.

Certain statistics with regard to the U.K. were shown as 'not available'—for instance, the number of inhabitants of the area served. Such information with regard to the U.K. could be prepared without any great difficulty. To a close approximation, in the Eastern Gas Board 77% of the inhabitants were served, and the Board represented a rural area, so that for Great Britain as a whole the figure might well be over 80%, which would represent the greatest proportion of service of gas to the total population of any country.

## PREVENTION OF GAS EXPLOSIONS

For the Sixth International Gas Conference in New York, the Netherlands Gas Association prepared a paper on safety regulations in gas works, which was the result of a questionnaire sent to 12 member countries. The information contained in the paper on explosions, in connection with the repair of plant and gasholders,

forms the subject of this paper by Mr. G. Rasmussen, works manager of the Eastern Gas Works at Copenhagen. He discusses the underlying principles of the use of purging gases, generally carbon dioxide or gas from an inert gas generator. By means of triangular diagrams he explains the safe limits of gas composition between the combustible gas, carbon dioxide and air, and how the application of this knowledge ensures that the purging and 'rinsing' of gasholders is perfectly safe.

### Dangers from Static Electricity

In a section on sources of ignition, he stresses the dangers to be met with from static electricity, and points out that it is possible to generate high static voltages of great potential danger by wearing clothes of unsuitable materials, the pumping of benzole through rubber tubing and other little-suspected sources. The ignition of gaseous mixtures may be caused by sparking from steel tools or pyrophoric deposits in gasholders, detarrers and gas mains. Their presence may be completely unsuspected until air is admitted after purging. Any pockets of gas there may be remaining will immediately be ignited.

The author goes on to enumerate the kind of precautions which should be taken when opening-up major pieces of plant for repair. As individual sections of plant get larger and as gas production becomes more concentrated, greater care must be taken; and to make certain that nothing is left to chance a written operational order should be given to the foreman, showing the exact sequence in which the safety precautions are to be taken. He comments on the lack of proper safety regulations in several countries but refers with appreciation to those in America, Great Britain and Switzerland. He points out that although the Swiss first drew up their safety measures in 1911, they were so far ahead that it is only now that they need revision. The Swedish Association has issued a booklet on the placing of gasholders and attendant equipment, rules for inspection and maintenance, but almost nothing about purging and safety measures.

The International Gas Union should, therefore, make it its business to issue to all member countries up-to-date and comprehensive safety regulations modelled on those in use in the U.S.A. and the United Kingdom.

## DISCUSSION

Mr. J. H. DYDE (G.B.), opening the discussion, said the fact that there were relatively few accidents would seem to indicate that engineers on the whole took reasonable precautions on their own initiative, and in the past gas plant was less complicated than now.

With the increasing use of electrical gear and the added complexity of new techniques, risks were becoming greater. There always remained, however, the simple source of ignition, such as the metal tool or the metal toecap of a boot. There also remained the human element in accident prevention, which resolved itself into inculcating a high degree of safety consciousness into supervisors and workmen.

Consideration of safety was an immense subject, and Mr. Rasmussen had wisely confined his paper to the aspects of explosion risks connected with repairs.

Mr. J. G. DE VOOGD (Holland) referred to various methods of determining air-gas mixtures, including the rule-of-thumb method of the change of note of an ordinary whistle blown with gases of different specific gravities.

Mr. T. C. BATTERSBY (G.B.) said the author had done well to stress in the first place the importance of avoiding the creation of an explosive mixture rather than the secondary step of eliminating sources of ignition. Apart from the risks of an explosion inherent in an electrostatic detarrer at work, they would all agree with the author that the greatest explosion risks arose when carrying out a repair programme and he had focussed attention on the need for the careful controlling of purging when gas holders were put out of or brought into commission, so that the mixture was maintained outside the explosion limits.

One of the first inert gas purging machines was introduced into England in 1934 and was the subject of a paper by F. M. Birks, and in 1947 L. Silver read a paper entitled 'The Purging of Gas Holders.' In this, he showed how the Le Chatelier rule could be extended to the more complex mixtures.

### I.G.E. Recommendations

The Recommendation of the I.G.E. with regard to the inspection and maintenance of gas holders was revised in 1954 and now embraced all types of holders and directed attention to the appropriate Factories Acts and Regulations and made special reference to purging techniques.

With the collaboration of the area boards, the I.G.E. was able to examine the circumstances in which accidents occurred, and in the light of that information, consideration was given to the need for drafting a code of safe practice; but generally the aim was to enumerate broad principles rather than give too detailed recommendations.

There was no doubt that the only completely safe method of purging a vessel of inflammable gas was by its displacement with an inert gas. It arose in some cases, particularly in small works, that a supply of an inert gas was not always available, so that the I.G.E. accepted as an alternative the purging by steam. There were, of course, limitations to the use of steam but detarrers were examples of vessels quite suitable for its use as the purging medium.

### International Regulations?

The author mentioned the possibility of the International Gas Union drafting standard safety regulations, presumably with a view to their universal adoption. Such a proposal presented many difficulties. In Britain they had many obligations under the Factories' Acts of 1937 and 1948 and maybe other countries had their own legislation. He was, however, sure it would be to mutual advantage to exchange records of unusual accidents through the medium of the I.G.U.

### Electric Contacts; Earth Resistance Tests

The author dealt specifically with works safety but he referred to electric bells in domestic dwellings causing explosions. Recently, the I.G.E. carried out a study of the risks of fortuitous electric contacts on the distribution and utilisation side. The findings were rather startling.

While the gas industry might prefer to see complete segregation of its services from those of the electricity industry, it was realised that this was rarely achieved, even on intentionally insulated gas services, since all underground structures such as pipelines and electric cables shared a common earth. When, however, a gas water heater was installed, there was an automatic bonding of the gas and water services.

In order to examine the position in this regard, the ad hoc Committee arranged to carry out a series of earth resistance tests.

Approximately 500 such tests had been made. They were

at random and included domestic premises of all types, and a number of small and large factories.

The results showed that in 70% of the tests the resistances between gas, water and electricity services were between 0 and 1 ohm., and in 88% of the tests between 0 and 5 ohms. There was little doubt that the incidence of an isolated gas service was something less than 5%.

### Case of Water Heaters

The installation of an electric immersion heater provided a very low resistance path to earth between the electric and water services. Similarly, the installation of a gas water heater provided a very low resistance path to earth between the gas and water services. In the case of a service isolated by an insulating coupling for cathodic protection purposes, the results varied widely; and it would appear that the reason was that, wherever such an insulating coupling was installed, it was always liable to be short-circuited through the water service at a common connexion between, say, water and electric or water and gas, possibly in other premises. In general it would appear that, while the insulating coupling might be satisfactory from a cathodic protection point of view, it was likely to be ineffective when related to the leakage from an electrical installation.

It had been noted that, in the majority of cases, the relative earth resistances between the individual installations and the temporary earth spikes used for the tests was of an order as high as several hundred ohms. This emphasised the difficulty of obtaining adequately low earth resistance values by the use of individual earth electrodes in consumers' premises.

### Common Earthing System

In these circumstances it would appear desirable to provide a common earthing system for the various services (gas, water and electricity) which would ensure a definite earth path for any leakage or fault current which might arise. They should agree, however, that in no circumstances should the gas installation be used as the only permanent earthing system."

Mr. J. H. DYDE, winding-up the discussion, said that in England factory regulations ensured that certain steps were taken, but much was left to the gas industry itself. Therefore the Institution of Gas Engineers had drawn up safety recommendations, and these were continually being added to. The looseleaf book of these safety recommendations was the vade mecum of all in charge of works plants and distribution operations. In many countries, as Mr. Rasmussen had said, there were no such regulations.

There was no doubt that a universal code of regulations or recommendations, to which the gas industries of various countries would conform, was desirable, but any question of legal enforcement could only be dealt with by individual countries. The question could be referred to the Council of the I.G.U.

## REFINERY GASES AT NAPLES

For the past two years refinery gases from the neighbouring Socony-Vacuum refinery have been successfully used at the Naples gasworks. The problems facing their storage and direct utilisation on the district are described by the author, Dr. D. E. Galanti, of the Naples Gas Company. Storage is likely to prove difficult because of the possibility of the separation of $C_5$ products and higher homologues, and the increased density of these gases may cause an increased pressure on the holder which would blow the water seals. Their direct use on the district would involve the dilution with so much inert material, to reduce their calorific value to that of normal town gas, that the heat output from the burners on the district would be reduced.

In order to utilise these gases to the full, means of cracking and subsequent use on the works was resorted to. These may be divided up under three main heads —heating of the continuous vertical retort settings, admission of gas at the base of the retort to increase its thermal output, and admission to the producer plant. To utilise the refinery gas for heating the retort settings, it was first mixed with large volumes of air and subjected to a conversion treatment with steam to produce a gas of similar constituents to ordinary producer gas. About 50% of the plant at Naples can now be fired by this type of reformed gas. Cracking and reforming the refinery gas in the retorts themselves is carried out by mixing it in varying quantities with steam, the proportions of each varying as to whether the sensible heat of the coke is to be recovered or part of the coal carbonised is to be replaced. This mixture is admitted at the base of the retorts in place of steam alone. With continuous working over short periods, the thermal output of the plant has been increased by 50% or above.

### Two-stage Producer

Cracking and reforming in a two-stage producer may be carried out by introducing a similar refinery gas-steam mixture under the grate. The producers at Naples are equipped with regenerators packed with silico-aluminous refractory chequer work. The steam-gas mixture may be successfully introduced in these regenerators. The temperatures of processing are 1,000° to 1,100°C. and 700° to 800°C. respectively. The thermal output of the plant may be increased by 30 to 40% in this way, and even higher if the formation of carbon black is avoided.

The paper points out that the use of refinery gas does not constitute an essential supply of energy to the Naples gasworks; but where it has been employed, the plant has shown an appreciably increased output of a gas differing little in essential characteristics from that it normally produces.

## APPLIED CHEMICAL ENGINEERING

MR. J. H. DYDE (G.B.), from the Chair, said: The paper which is now to be presented by two of my English colleagues must, I am sure, have a wide appeal to those interested in the *design* and operation of plant for the cooling and purification of fuel gases.

In the early stages of development of the gas industry the design of such plants was on empirical lines by a process very largely of trial and error. In recent years the physico-chemical phenomena involved in these processes have been investigated, and the accumulated knowledge applied to improving design and consequently performance, thereby reducing operational costs.

The authors survey the field of these improvements, and they are indeed substantial. It is a paper of fundamental character which will no doubt be read widely by students, extending, as it does, the threshold of our experience in the application of fundamental principles to commercial development.

## DOUGILL-SPIVEY REVIEWED

In the past the design of much gasworks ancillary plant for cooling and wet and dry purification was empirical. A manufacturer might well have developed satisfactory ancillary plant purely as a result of past experience. Such plant has been inherited by the carbonising industries and it was not until the size of the installations began to increase with increased loading on individual pieces of plant that it became necessary to study ancillary processes in greater detail. Little or no thought had been given to the basic principles on which these processes depended, so that it was impossible to improve the efficiency of operation or reduce the cost of gas processing per unit of gas treated.

The study of chemical engineering principles has revealed a great deal of what constituted the weaknesses of the older plants, not only in their low loading capacities but also in the tendency towards corrosion in certain sections and the expense of maintenance involving unduly long periods out of service.

**Mr. George Dougill introduces his and Dr. Spivey's paper**

This paper by G. Dougill, Planning Engineer, and E. Spivey, Senior Chemical Engineer, of the North Thames Gas Board discusses the processes involved in the treatment both of coke oven gas and coal gas from its manufacture in the carbonising plant to its entry into the trunk main or works holder.

The paper is remarkable for the clarity with which it describes the way improvements in plant design have been arrived at without resorting to complicated mathematical formulæ. The authors first describe the treatment of coke oven gas since this is liable to cause greater difficulties than coal gas manufactured in conventional gas works plant. Coke works plant must be able to operate for longer periods at a higher level of output without blockage caused by solids separating out in the process. The tendency in recent years to install not only larger individual pieces of plant but also larger collections of plant is evident in both carbonising industries, and this has led to a consideration of the largest sizes of ancillary plant at the lowest cost per unit of gas treated. The chemical engineering calculations show that the optimum point is reached between 10 and 15 mill. cuft. per day.

The improvement in the design of much of the ancillary plant now being installed in modern gas works is the result of work by both the gas industry and the manufacturers, with the result that many problems facing both have been successfully solved, and plants individually suitable for the actual work expected of them have been designed and installed. It is interesting to consider, however, that one piece of ancillary plant, now in common use, has been developed entirely by the manufacturers as a result of the consideration of basic principles alone. This is the electrostatic detarrer. The most advantageous position of this piece of ancillary plant in the wet purification of coke oven gas, coal gas and water gas is considered in the paper.

### DISCUSSION

MR. F. G. PYPER (G.B.) said he was very pleased to have the opportunity of joining in the discussion on an excellent paper, which summed up briefly but comprehensively solutions to the many problems associated with the cooling and purification of gas. It was of particular interest to him as, in the years before the war, Mr. Dougill and he worked together on the purification plant in general at Beckton and, in particular, on that associated with the first battery of coke ovens.

The coke oven purification stream seemed to give them all the problems there were to solve—serious naphthalene deposits, poor ammonia washing, very serious corrosion on the primary condenser tubes and governing troubles on the exhausters due to the P. & A. tar extractors on the suction side. It was very satisfactory to know that the seeds which were sown during those discussions had come to fruit in the paper before them.

A large part of the corrosion troubles in the tubes of primary condensers had been overcome by the use of vertical instead of horizontal tubes. On one or two condensers in the East Midlands area they had carried this a step further and had introduced sacrificial anodes in the top and bottom water spaces, which had been successful in considerably extending the life of the tubes.

He was very interested in the mention of the atmospheric condenser with external evaporation over the pipes. He felt there was a good deal to be said for this type of condenser; indeed, one had recently been installed at a works in Sheffield on a stream of horizontal chamber gas. It had been made reversible so that the naphthalene could be melted out. It had not yet been put on full load as the carbonising plant would not be complete for another year or more, but its performance so far had been completely trouble-free. The capital cost was, of course, considerably higher, but the saving in the cost of water pumping and cooling as well as much reduced maintenance made it a practical proposition.

#### *Refrigeration Methods*

Looking back at the pre-war days at Beckton again, they had considerable discussion on the possibility of using low-pressure steam in a vacuum refrigeration plant for chilling the cooling water for the gas. This, he thought, would only be justified where such steam was available and where it could not be better used. He would be interested to hear whether the matter was pursued any further.

Another idea, which was discussed immediately before the war, was the possibility of using the absorption method of refrigeration, by which the heat of the incoming gas could be used for cooling the water for the secondary cooling unit. In this way, the more heat there was in the gas the cooler was the water available for the secondary stage. This appeared to be a very elegant solution to the problem, but he had no doubt it would have been somewhat complicated.

Turning to the subject of dry purification, some of the liquid processes appeared attractive, and the progress of the vacuum carbonate process at Beckton would be fol-

lowed with interest. Like other liquid processes, this required the removal of the last traces of hydrogen sulphide to the required British standard by other means. No-one who had had experience of catch boxes could regard them as a happy solution. The normal dry oxide process was so simple and cheap that they must have something very much better to take its place. In the large units of towers, where the oxide could be changed quickly and simply with a suitable handling plant, and where enough steam was admitted in the right quantities at the right point in the stream, they had experienced little or no trouble. If a simple, cheap and reliable plant for the removal of the last traces could be evolved to follow one of the liquid processes, some real advance might be made.

**Mr. F. G. Pyper, Chief Engineer, East Midlands Gas Board, who made a notable contribution to the Dougill-Spivey paper on the application of chemical engineering principles to the cooling and purification of gas.**

He congratulated the authors on their comprehensive paper, which would be used as a source of reference for some time to come.

### *Putting the Chemical Engineer on the Map*

Mr. K. W. FRANCOMBE (Whessoe Ltd., Darlington) claimed that Mr. Dougill and Dr. Spivey had now put the work of the Chemical Engineer in the gas industry on the international map.

They stated that the developments in modern gasworks plant were sometimes due to the gas industry, sometimes to its contractors, and sometimes by collaborative effort between the two. His Company had for many years been privileged to collaborate with the North Thames Gas Board and they had always regarded that collaboration as one of their most fruitful sources of inspiration. Nowhere was this collaboration between the industry and its contractors more apparent than at the Annual Meetings of the Institution of Gas Engineers.

He would like to emphasise that the paper dealt with the North Thames' own approach to these problems and that it did not necessarily typify current U.K. practice, as different gas boards and coke works had their own ideas on some of the subjects discussed. He would like to mention a few of these divergencies.

### *Divergence from N.T.G.B. Practice*

For example, at many gas and coking plants the primary coolers would reduce the gas temperature only to about 35°-40°C. to avoid naphthalene condensation. Then would follow the exhausters and electro-detarrers, after which the naphthalene would be washed from the gas in multi-stage scrubbers prior to secondary cooling which could then be effected without risk of naphthalene condensation. Relatively few gasworks would then go to the expense of secondary detarrers for trace oil-fog removal prior to ammonia scrubbing.

Regarding the design of primary coolers, the authors showed a type of horizontal gas flow, vertical water tube cooler in which the gas zig-zagged from side to side. He, the speaker, preferred the type in which the gas flowed horizontally straight through the condenser and back again, usually in two gas-passes side by side. This provided better gas distribution with minimum pressure loss and allowed of any desired number of water passes quite independent of the gas passes.

He thought that the temperature rise of 3°C. through centrifugal exhausters, quoted by the authors, was exceptionally low; he would regard 10°C. as more typical. I.G.U. Paper 7-58 quoted figures ranging from 5° to 25°C.

### *Benzole Extraction*

The authors referred to the extraction of benzole following the $H_2S$ purification plant, and this sequence was necessary if active carbon was employed. But at many coking works benzole extraction by oil-washing was practised before $H_2S$ purification in which case creosote oil was often employed and was sometimes followed by a final stage of naphthalene extraction using a petroleum-based oil.

Now a note regarding the capacity of individual units in the purification stream—another very potent reason why they should not be larger than the sizes quoted by the authors was that in the U.K. it was now generally considered desirable to arrange for the stress-relief of welded steel units to avoid the possibility of stress-corrosion cracking; and if they were any larger it would be very difficult to arrange for their stress-relief in a furnace.

### *Best Purification Practice*

Mr. R. J. S. THOMPSON (Chemical Engineering Division, W. C. Holmes & Co., Ltd.) said the authors had given an excellent account of the best practice in purification of town gas as used in England to-day. An important point to realise was that there was no high-pressure distribution of town gas in England such as existed on the Continent. The maximum pressures used amounted to only two or three atmospheres. In these circumstances it was not possible to adopt many of the measures used on the Continent such as high-pressure purifiers, drying by refrigeration, removal of nitric oxide by using a delay chamber at 95°C., and so on.

It should also be remembered that the concentration of hydrogen sulphide in gases made from English coals was usually much higher than that found in most Continental gases. English crude coal gas normally contained at least 15 g. of hydrogen sulphide per cub. m., and it might reach 25 g.

### *English and Continental Differences*

On the Continent concentration was high, as 10 g. per cub. m. was the exception rather than the rule. The ammonia concentration in English crude coal gas was much the same as on the Continent. All this had a considerable influence on the operation of the purification plant. The heat produced in English oxide purifiers was much greater than in normal Continental ones, which made their operation more difficult.

Many Continental readers would find the use of vertical tube condensers in English works very strange. It was a fact, however, that horizontal tube condensers had fallen out of favour, and none had been installed for many years. The basic reason was the difficulty of cleaning the tubes, which under English conditions must be carried out frequently. Many varieties of vertical tube condensers had been designed—all intended to take advantage of high gas and water velocities—and that illustrated in the paper was one which achieved the desired results satisfactorily.

## CONFERENCE VENUE

**A view of the F.A.O. Buildings, headquarters of the United Nations Organisation for Food and Agriculture, which provided for the I.G.U. Conference accommodation which in our opinion was the best ever experienced for the purpose. Apart from the luxurious conference rooms, delegates had at their disposal a post office, bar, restaurant, air travel bureau, tourist agency, two shops and a magnificent view of Rome from an eighth-floor terrace.**

The washer cooler had not found much use in England except for final cooling after semi-direct saturators, but this was not being installed on modern plants.

In connection with the fundamental principles of design of condensers, he referred to the work of Bolzinger in France, which was not mentioned in the bibliography.

### *Naphthalene Removal*

In connection with naphthalene removal before the secondary gas coolers, it should be made clear that the plant described by the authors used gas oil. Plants were also in use using creosote oil successfully. In that case it might be necessary to install heaters in the washer to maintain the oil in the washer at a temperature equal to or higher than the gas temperature, or condensation of water would occur as the gas was at a higher temperature than atmospheric. Using creosote oil in particular, this could give rise to difficult emulsions.

### *Coke Oven Ammonia Recovery*

In dealing with the recovery of ammonia from coke oven gases, the authors quite rightly stated that the direct process had fallen out of favour. They stated the reasons, and also inferred that the indirect process was to be preferred to the semi-direct process.

As at present practised, he agreed with that, but suggested that the time had come to reconsider the situation. With the technique now available it should be possible to revive the direct process, using a hot electrostatic detarrer to remove the tar and ammonium chloride, and replacing the saturator with an acid washer. The advantage of this would be that the liquor produced in the condensers would be ammonia free and probably of very much improved quality from the point of view of disposal. In many cases it could be run straight to the drain. The objectionable constituents of liquor would then be concentrated in a small volume of fixed ammonia liquor.

### *H S and Benzole*

In dealing with the removal of hydrogen sulphide from carburetted water gas, the authors referred to the use of a suspension of iron hydroxide in soda solution, the process there described being that commonly referred to as the 'Manchester' process. This process had also been used on a large scale for purifying coal gas, and several installations were in operation in England, successfully cleaning the gas to Referee's standard, while others were in use for partial removal. The process was being used on coke oven gas and vertical retort gas.

**Mr. R. J. S. Thompson, of W. C. Holmes & Co., Ltd., whose wide experience of Continental practice was revealed in his contribution to the discussion.**

So far as benzole recovery was concerned, he agreed with the authors. The vacuum recovery process was now widely used in gas works in England, and many large installations had been built, operating both on coke oven gas and gas from other carbonising systems. It would appear strange to Continental readers that plants using pipe-stills were not used in England.

Mr. J. H. DYDE, closing the session, said the paper would always be valuable as an example of the application of fundamental principles to practical problems.